United States Patent

Buckingham

[15] **3,660,911**

[45] **May 9, 1972**

[54] FILM DRYING DEVICE

[72] Inventor: **Donald A. Buckingham,** Evanston, Ill.

[73] Assignee: **Buckingham Graphics, Incorporated,** Evanston, Ill.

[22] Filed: **June 18, 1970**

[21] Appl. No.: **47,303**

[52] **U.S. Cl.**.....**34/160,** 34/155, 239/566, 239/568

[51] **Int. Cl.**.....**F26b 13/00**

[58] **Field of Search**.....34/160, 155, 162; 239/566, 239/568

[56] **References Cited**

UNITED STATES PATENTS

1,507,002	9/1924	Roeder	34/160 X
1,543,297	6/1925	Robinson	34/160 X
1,605,856	11/1926	Serva	34/160 X
3,025,779	3/1962	Russell et al.	34/160 X

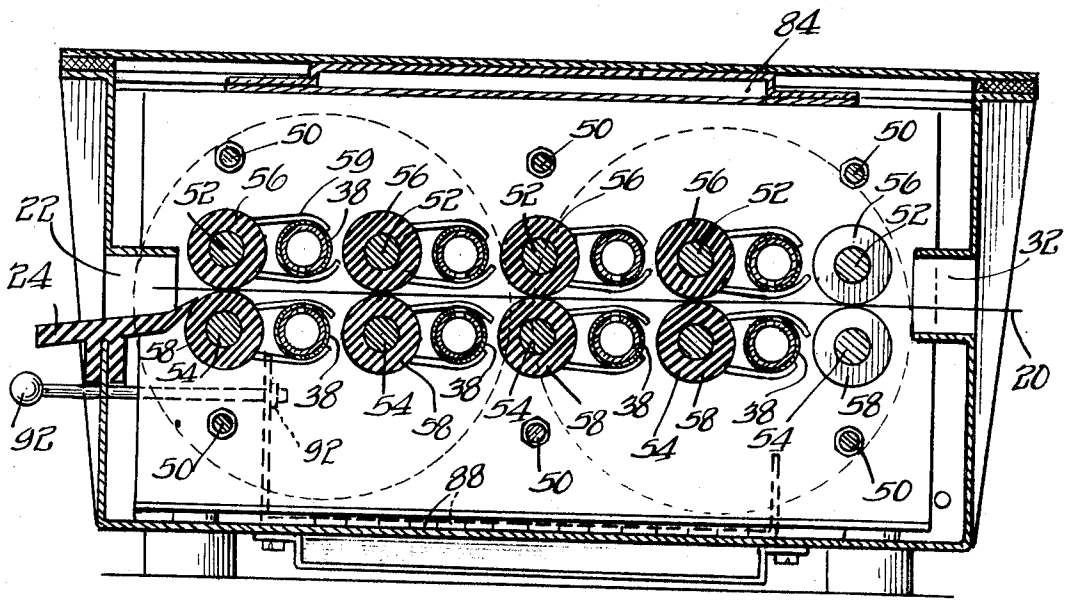
Primary Examiner—Carroll B. Dority, Jr.

Attorney—Olson, Trexler, Wolters & Bushnell

[57] **ABSTRACT**

A device for drying film comprising a housing, a transfer assembly connected to the housing for delivering sheets of film along a predetermined path, means for producing a continuous flow of warm air and a plurality of tube assemblies for directing the flow of warm air to the film for drying the same.

10 Claims, 8 Drawing Figures



PATENTED MAY 9 1972

3,660,911

SHEET 1 OF 2

Fig. 1.

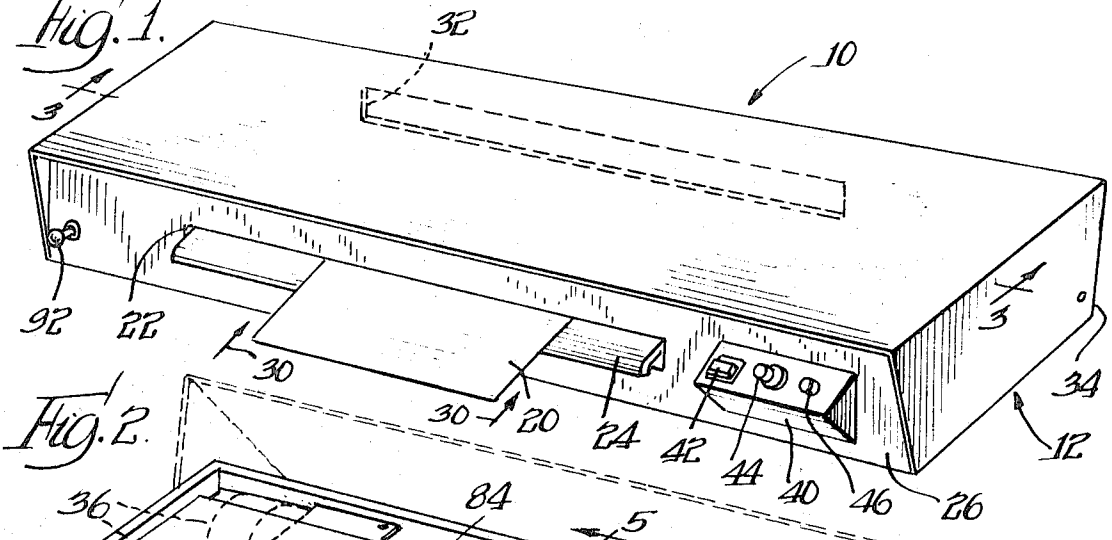


Fig. 2.

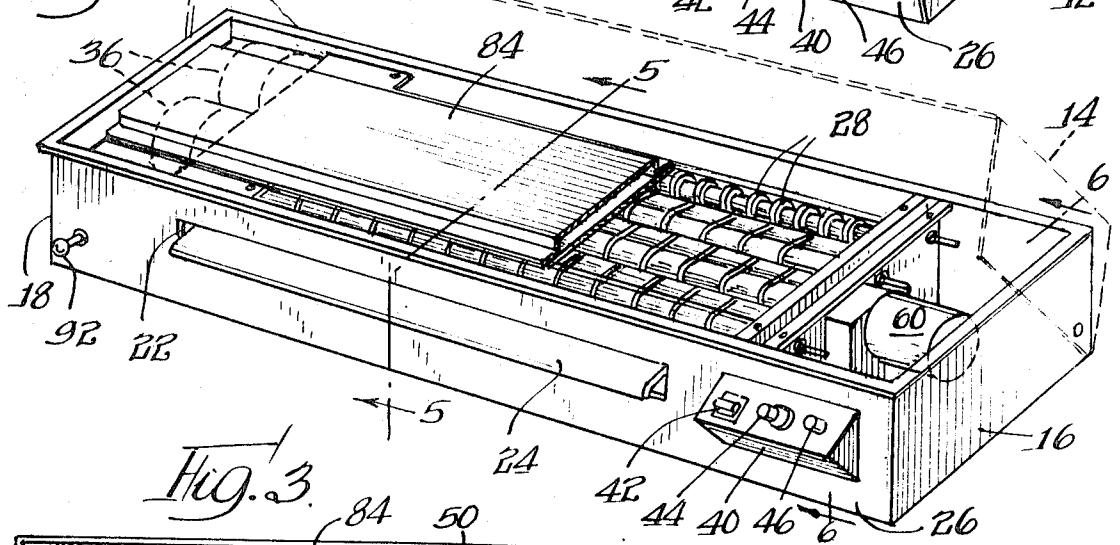
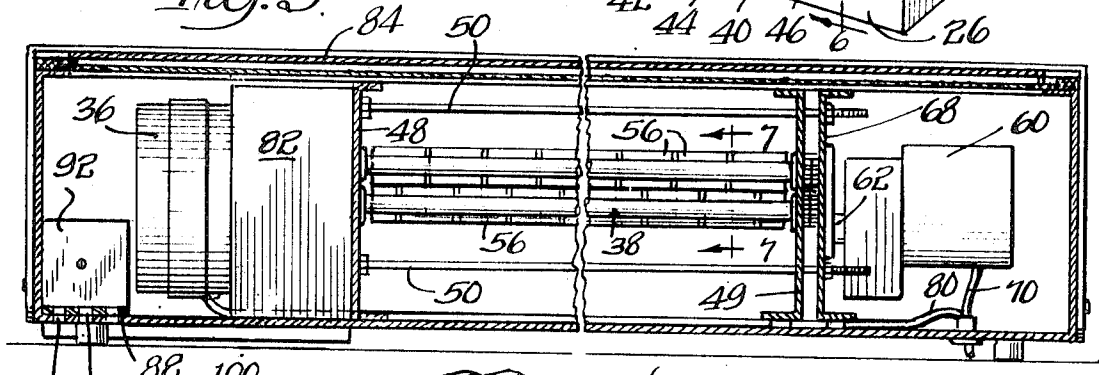


Fig. 3.



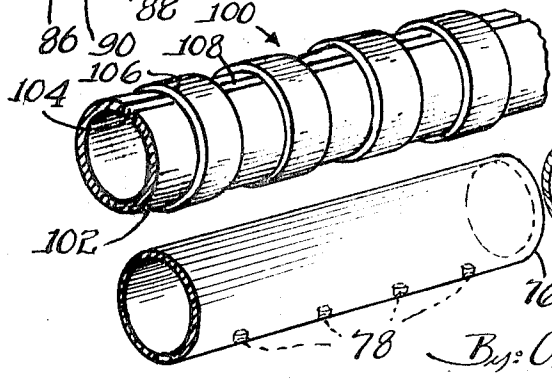


Fig. 4a.

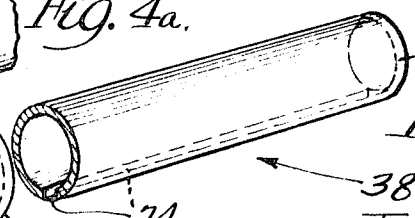


Fig. 4.

Inventor
Donald A. Buckingham
By: Olson, Trexler, Wolters & Bushnell attys.

Fig. 5.

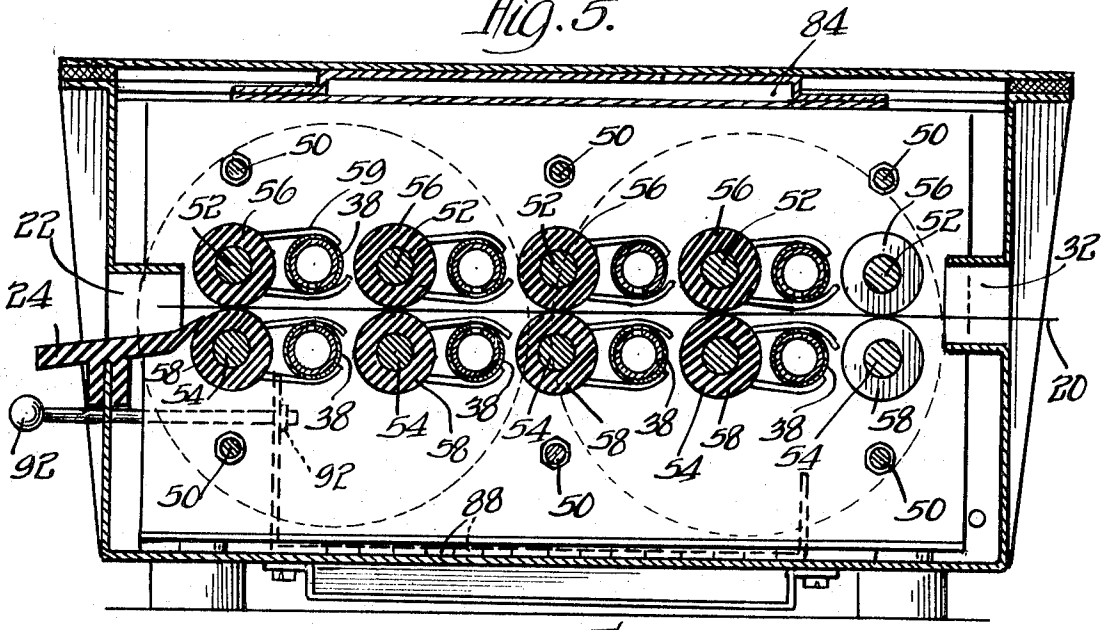


Fig. 6.

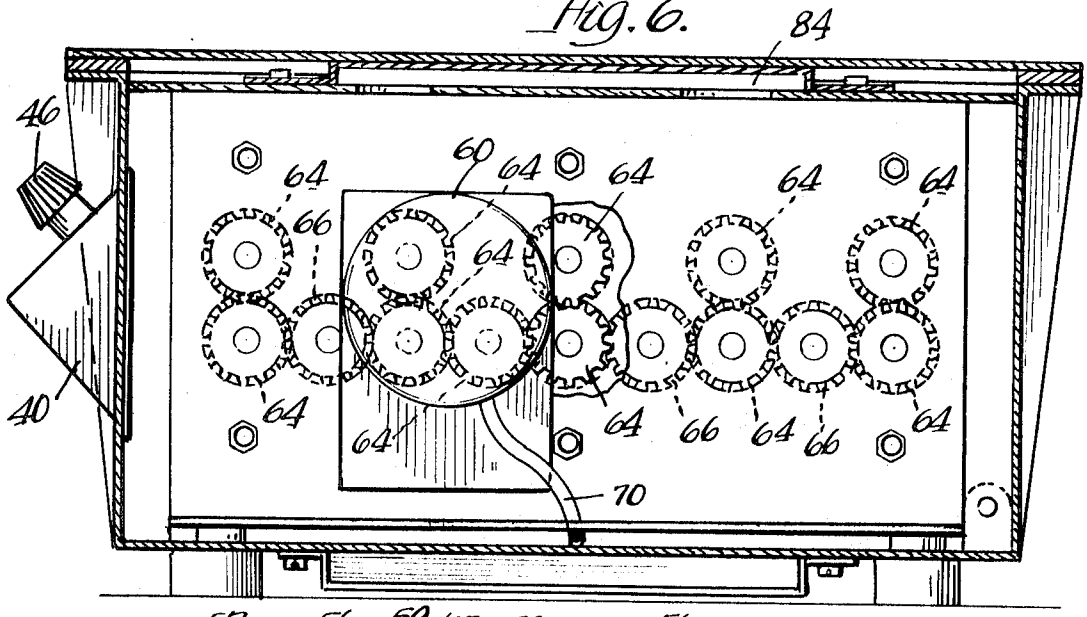
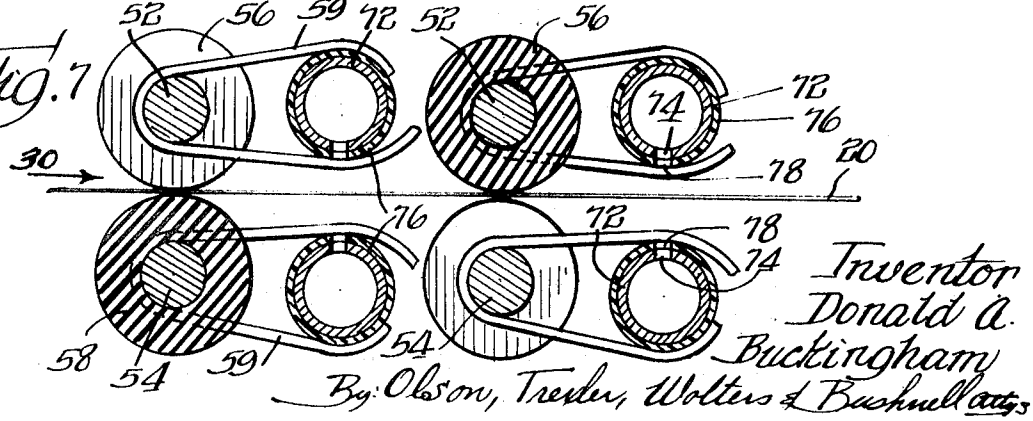


Fig. 7



Inventor
Donald A. Buckingham
By: Olson, Trexler, Wolters & Bushnell Attys

FILM DRYING DEVICE

SUMMARY OF THE INVENTION

This invention relates generally to dryers and more particularly to devices for drying sheets of film and other suitable sheet material.

DISTINCTION OVER PRIOR ART AND OBJECTS

Film drying devices generally of the type herein disclosed and claimed are well known and include a transporting assembly for delivering the film over a predetermined path and air circulating means for drying the film during the transportation thereof. In the past, various types of air circulating means were provided, sometimes augmented by air heating means, depending upon both economic and functional considerations. For example, one widely used structure includes a metal tube with a plurality of apertures directing a continuous flow of air to the film. While this type of device is quite satisfactory from a functional standpoint, it has been found to be quite expensive to manufacture, the expense residing substantially in the drilling operation required for making the aforesaid apertures. In order to eliminate this drilling operation and thereby reduce cost, a tube having one continuous slot has been proposed. However, since the slot prevents sufficient air pressure to build up, all of the air tends to leave the tube at the inlet end of the slot and thus makes this type of structure ineffective.

Accordingly, a general object of the present invention is to provide a new and improved film drying device which overcomes the aforementioned prior art deficiencies.

A more particular object of the present invention is to provide a film drying device which includes a new and improved assembly for directing a continuous flow of warm air to the film.

Another object of the present invention is to provide an assembly of the aforesaid type which is both simple in design and economical to produce.

Yet another object of the present invention is to provide an assembly of the aforesaid type which is constructed of inexpensive sheet metal and heat shrinkable plastic.

Yet another object of the present invention is to provide a new and improved method of making the aforesaid assembly.

These and other objects and features of the invention will become more apparent from a reading of the following descriptions.

The above stated objects are achieved and the prior art deficiencies are eliminated by the utilization of a new and improved assembly for directing the flow of sufficiently warm air to transported film for drying the film while in transit. The assembly generally comprises a plurality of circumferentially discontinuous cylinders or tubes, each of which has a continuous longitudinally directed slot extending therethrough. A cylindrical sleeve constructed of heat shrinkable material is positioned around the circumference of the tube and includes a plurality of apertures disposed over the slot. The flow of air is directed through the tube and exits, with substantially equal pressure, through the apertures. Each tube is constructed of sheet metal which is rolled to form the circumferentially discontinuous design. Each sleeve, which initially has a diameter slightly larger than the rolled tube, is slipped over the latter and is thereafter heated so as to shrink tightly against the tube. In a modified embodiment, the aforementioned cylindrical sleeve is replaced by a plurality of shorter longitudinally spaced sleeves of the same material, but which do not include apertures. Rather, the flow of air is directed through portions of the slot which are positioned between the sleeves. In this manner streaking of the film, especially colored film, is minimized.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, both as to its structure and mode of operation, will be better understood by reference to the following disclosure and drawings forming a part thereof, wherein:

FIG. 1 is a perspective view of the film drying device, in accordance with the invention;

FIG. 2 is a perspective view of the film drying device of FIG. 1 with its hood in an opened position;

FIG. 3 is a front-sectional view of the film drying device taken generally along line 3—3 in FIG. 1;

FIG. 4 is an exploded perspective view of one air flow tube assembly used with the present invention;

FIG. 4*a* is a perspective view of a modified air flow tube assembly according to the present invention;

FIG. 5 is a cross-sectional view of the film drying device taken generally along line 5—5 in FIG. 2;

FIG. 6 is a partially broken away cross-sectional view of the film drying device taken generally along line 6—6 in FIG. 2; and

FIG. 7 is a simplified blown up sectional view taken generally along line 7—7 in FIG. 3.

DETAILED DESCRIPTION

Referring now in detail to the drawings, wherein like components are designated by like numerals, a film drying apparatus constructed in accordance with the present invention is generally designated by the reference numeral **10** and includes rectangular housing **12** having a lid or cover **14** swingably connected to its side panels **16** and **18**, as seen in FIGS. **1** and **2**. The housing comprises a basic supporting structure and establishes a positional reference for the associated parts described hereinafter.

A sheet **20**, preferably of black and white acetate film, but which may be any other sheet material which can be adequately dried by moving air, enters the apparatus **10** through an entrance slot **22** positioned over a protruding guide **24** which is located in a front panel **26** of housing **12**. The sheet is thereafter advanced by a transporting assembly **28**, as indicated by arrows **30** (FIGS. **1** and **7**), longitudinally of and generally situated between side panels **16** and **18**, to an exit slot **32** located in the back panel **34** of the housing.

As the sheet of film or other material advances between entrance and exit slots **22** and **32**, respectively, it is supplied with a substantially evenly distributed continuous flow of warm air, which completely dries the sheet while in transit. This supply of air is provided by two electrical blower assemblies **36** (FIG. **2**) and a plurality of tube assemblies **38** (FIG. **4**) which will be described in more detail hereinafter. A control panel **40** is provided on front panel **26** of the housing and includes an actuator or feed switch **42**, a speed control **44** for varying the speed at which the sheets pass through the apparatus, and a fuse receptacle **46**.

Referring now to FIGS. **3** and **5**, the transporting assembly **28** includes two laterally spaced mounting brackets **48** and **49** which are suitably mounted within housing **12** and which are laterally spaced inwardly from respective side panels **18** and **16** by a plurality of spacer rods **50**. The brackets rotatably support, by journals or other suitable means, a plurality of equally horizontally spaced and transversely extending upper shafts **52** and lower shafts **54**, each of the lower shafts being vertically aligned below a corresponding upper shaft.

Each of the upper shafts carries a plurality of resilient, preferably foam rubber, rollers **56** while each of the lower shafts carries a plurality of identical rollers **58** which are positioned directly below rollers **56**. With the exception of the extreme left hand and extreme right hand rollers as viewed in FIG. **5**, rollers **58** are axially horizontally offset, half their lengths with respect to rollers **56**, as can best be seen in FIG. **7**. The upper shafts **52** and lower shafts **54** are appropriately spaced apart so that rollers **56** press against rollers **58**. In this way, when the upper and lower shafts and corresponding rollers are rotated in a manner to be described hereinafter, sheet **20**, which is inserted through entrance slot **22**, passes between and is driven by the rollers. The sheet is additionally guided therethrough by a plurality of clips or guide pins **59** which are mounted between the rollers and connected to tube assemblies **38**.

Turning to FIGS. 3 and 6, transporting assembly 28 further includes an electric drive motor 60 having an output shaft 62, a plurality of spur gears 64 and idler gears 66, all of which co-operate for rotating upper shafts 52 in a counter-clockwise direction, as viewed in FIG. 5, and for simultaneously rotating lower shafts 54 in a clockwise direction, whereby sheet 20 is moved in the aforementioned manner.

Drive motor 60 is suitably mounted to a bracket 68 which in turn is mounted within and to housing 12 between mounting bracket 49 and side panel 16, the drive motor being connected to an external source (not shown) by a conduit 70. Output shaft 62 extends through bracket 68 and carries on its extremity one of the spur gears 64 which is positioned between the bracket 68 and bracket 49, the output shaft and associated spur gear being driven in a clockwise direction, as viewed in FIG. 6. In like manner, the remaining spur gears 64 are mounted to corresponding upper and lower shafts 52 and 54 and idler gears 66 are mounted for rotation to and between the brackets. As seen in FIGS. 3 and 6, the gears co-operate with each other for driving the shafts in the aforementioned manner.

In accordance with the present invention, a tube assembly 38, shown in FIG. 4, comprises a circumferentially discontinuous cylinder 72 having a continuous slot 74 extending longitudinally along the entire surface of the cylinder and a cylindrical sleeve 76 having a plurality of equally longitudinally spaced apertures 78 extending therethrough. Cylinder 72 is preferably made of inexpensive sheet metal which is appropriately rolled so as to form the aforesaid circumferentially discontinuous design. The cylindrical sleeve 76, which has an initial cross-sectional diameter slightly greater than the cross-sectional diameter of cylinder 72, is constructed of a heat shrinkable material such as polyethylene or polyvinyl chloride. The cylindrical sleeve is positioned around the cylinder so that apertures 78 are aligned with slots 74. Once this is done, the assembly is heated by an oven or other suitable means so that the sleeve shrinks tightly around the cylinder.

Each tube assembly is positioned alongside a corresponding upper shaft 52 or lower shaft 54, such that its apertures face either downward or upward, depending upon whether the particular tube assembly is positioned above or below sheet 20. One end of each tube assembly is mounted to and closed by mounting bracket 49 while its other end is mounted to bracket 48.

Electrical blower assemblies 36, which may be electric fans or any other suitable devices for creating airflow, are positioned within housing 12 adjacent side panel 18 and receive their power from an external source (not shown) via conduits 80. The blower assemblies are mounted to and partially within a closed housing 82 which in turn is mounted to mounting bracket 48. The blower assemblies produce a flow of air within housing 82, the air being forced into the plurality of tube assemblies 38 through co-operating apertures (not shown) in mounting bracket 48 and housing 82. This flow of air leaves the tube assemblies through apertures 78 with substantially uniform pressure, the flow of air being directed substantially uniformly over the top and bottom surfaces of sheet 20.

As stated above, the flow of air is sufficiently warm so as adequately to dry the sheets 20 as they pass through the apparatus. This is provided firstly, by the heat emanating directly from blower assemblies 36, this heat being captured within housing 82. Secondly, the heat emanating from drive motor 60 is directed to the vicinity of blower assemblies 36, through a manifold 84 which extends over the transporting assembly 18 and which is suitably mounted to sides 16 and 18 of housing 12. Fresh air for electric blower assemblies 36 may be provided through a plurality of apertures 86 in the bottom of housing 12. The amount of fresh air is regulated by a plate 88 which is slidably mounted over the apertures 86 and which includes a plurality of co-operating apertures 90 which may be moved into and out of alignment with apertures 86. An actuating arm 92 is appropriately connected to plate 88 for achieving this end.

Turning to FIG. 4*a*, a modified tube assembly, constructed in accordance with the present invention, is shown and generally indicated by the reference numeral 100. Assembly 100 is similar to tube assembly 38 in that it includes an identical circumferentially discontinuous cylinder 102 having a continuous slot 104 extending longitudinally along the entire surface of the cylinder. However, rather than using a continuous sleeve having a plurality of apertures, assembly 100 includes a plurality of substantially shorter sleeves 106, each of which is constructed of the same material and has the same initial cross-sectional diameter as sleeve 76 of assembly 38.

Sleeves 106, each of which is preferably approximately three-eighth of an inch long but which may be any desired length, are positioned around cylinder 102 and heated in the same manner as described with respect to tube assembly 38 for shrinking the sleeves tightly around the cylinder. The sleeves are longitudinally spaced-apart for exposing a plurality of like spaced portions 108 of slot 104, which portions are substantially rectangular in shape as illustrated in FIG. 4*a*.

Tube assemblies 100 are mounted and positioned to the remaining structure of film drying apparatus 10 in the same manner as assemblies 38, portions 108 facing sheet 20 for directing a flow of air thereto. It has been found, that by providing these substantially rectangular exposed portions of slot 104, the jet effect on the film produced by the flow of air is minimized. In addition, this construction eliminates damage to the tonal quality of colored film.

While a particular embodiment of the invention has been shown, it should be understood, of course, that the invention is not limited thereto since many modifications may be made. It is, therefore, contemplated to cover by the present application any such modifications as fall within the true spirit and scope of the appended claims.

The invention is claimed as follows:

1. A device for drying film comprising: support means; transfer assembly means connected to said support means for delivering said film along a predetermined path; blower means for producing a continuous flow of air to dry said film; and at least one tube assembly connected to said support means and co-operating with said blower means for directing said flow of air to said film, said tube assembly including a circumferentially discontinuous metal cylinder having a continuous longitudinally directed slot and plastic sleeve means circumscribing and fixed on said cylinder, said sleeve means having a plurality of small apertures disposed in a longitudinal row overlying the slot in said cylinder for exposing portions of said slot whereby said flow of air is directed to said film, said apertures each having substantially equal dimensions longitudinally and transversely of said sleeve.

2. A device according to claim 1 wherein said sleeve is constructed of a heat shrinkable material.

3. A device according to claim 2 wherein said heat shrinkable material is polyethylene.

4. A device according to claim 2 wherein said heat shrinkable material is polyvinyl chloride.

5. A device according to claim 1 wherein said circumferentially discontinuous cylinder is constructed of sheet metal.

6. A device according to claim 1 including a plurality of tube assemblies all of which are connected to said support means and co-operate with said blower means for directing said flow of air to said film in a substantially uniform fashion.

7. A device for drying film comprising: support means; transfer assembly means connected to said support means for delivering said film along a predetermined path; blower means for producing a continuous flow of air to dry said film; and at least one tube assembly connected to said support means and co-operating with said blower means for directing said flow of air to said film, said tube assembly including a circumferentially discontinuous cylinder having a continuous longitudinally directed slot and sleeve means circumscribing said cylinder for exposing portions of said slot whereby said flow of air is directed to said film, said sleeve means including a plurality of sleeves circumscribing said cylinder, said sleeves

being longitudinally spaced apart for exposing portions of said slot for directing said flow of air to said film.

8. A device according to claim 7 wherein said sleeves are constructed of heat shrinkable material.

9. A device according to claim 8 wherein said heat shrinkable material is polyethylene.

10. A device according to claim 8 wherein said heat shrinkable material is polyvinyl chloride.

* * * * *